Research article | Published: 01 October 2020

Effect of ambient air pollution and temperature on the risk of stillbirth: a distributed lag nonlinear time series analysis

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Journal of Environmental Health Science and Engineering **18**, 1289–1299(2020) | Cite this article

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Abstract

Objectives

This study aimed to determine the effect of ambient air pollution and temperature on stillbirth in Tehran.

Methods

In this time-series study, the effect of O_3 (ppb), CO (ppm), NO_2 (ppb), SO_2 (ppb), $PM_{2.5}$ ($\mu g/m^3$), and minimum, maximum, and mean daily temperature (°C) on stillbirth was evaluated in Tehran, Iran between March 2015 and March 2018. Using a quasi-Poisson regression model in combination with a Distributed Lag Non-linear Models (DLNM), the Relative Risk (RR) was estimated through comparing the high temperature (99th, 95th, and 75th percentiles) and low temperature (1st, 5th, and 25th percentiles) with the median. The effect of air pollution was estimated for each 1-, 5-, or 10-unit increase in the concentration during lags (days) 0–21.

Results

Among air pollutants, only a 5-ppm increase in the SO_2 concentration in lag 0 increased the risk of stillbirth significantly (RR = 1.062; 1.002–1.125). The largest effect of heat was observed while comparing the 99th percentile of minimum daily temperature (26.9 °C) with the median temperature (13.2 °C), which was not statistically significant (RR = 1.25; 0.95–1.65). As for cold, a non-significant protective effect was observed while comparing the 1st percentile of maximum daily temperature (3.1 °C) with the median temperature (23.2 °C) (RR = 0.92; 0.72–1.19).

Conclusion

Each 5-ppm increase in the mean daily SO_2 in lag 0 increased the risk of stillbirth by 6% while other air pollutants had no significant effects on stillbirth. In lags 0 and 1, the heat increased the risk of stillbirth while the cold had protective effects, which were not statistically significant.